National Aeronautics and Space Administration

NASA's **Aeronautics Test Program**

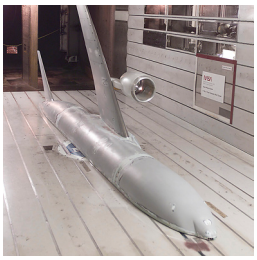
11-Foot Transonic Unitary Plan Facility

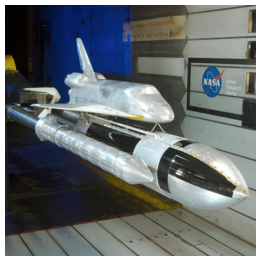
The 11-Foot Transonic Unitary Plan Facility is part of the Unitary Plan Wind Tunnel complex at NASA Ames Research Center at Moffett Field, California, where generations of commercial and military aircraft and NASA space vehicles, including the space shuttle, have been designed and tested.

The 11- by 11-Foot Transonic Wind Tunnel (11×11 TWT) is a closed-return, variable-density tunnel with a fixed-geometry, ventilated test section with a flexible wall nozzle. It is one of two separate test sections powered by a common drive system. A three-stage, axial-flow compressor powered by four wound-rotor, variable-speed induction motors, produces airflow.

Interchangeability of models among the unitary test sections allows testing across a wide range of conditions.

The 11×11 TWT has been instrumental in the development of virtually every domestically produced commercial transport and military fixed-wing airframe since the 1960s. The facility is used extensively for airframe testing and aerodynamic studies and has played a vital role in every manned space flight program, including NASA's new Orion space capsule, on which astronauts will fly to the International Space Station, the Moon, and beyond.





Facility Benefits

- Excellent optical access supports advanced flow techniques, including pressure-sensitive paint, particle image velocimetry, oil flow interferometry, infrared thermography, and Schlieren imaging
- Model supports include a rear sting, semispan turntable, 2-DWing, high-angle kick-sting, and a roll mechanism sting provides wings-level yaw capability
- High-pressure air at 3000-psi is digitally controlled, with preheating available and over 6 million SCF of storage
- A steady-state data system incorporates the latest technology in a flexible, modular configuration to satisfy the most demanding test configurations, with the capability of acquiring pitch-pause and continuous-sweep data
- Onsite instrumentation measures balance loads, model position, surface pressures, temperatures, and wind tunnel conditions
- An extensive library of standard aerodynamic computations is augmented by the ability to easily add customer-defined equations; corrections include wall interference and buoyancy
- A dynamic data system acquires more than 100 channels of dynamic and transient data, including unsteady pressures, acoustics, and dynamic structural loads

Facility Applications

- Commercial, military, and NASA programs

"[This] wind tunnel has set a new standard in test productivity and technical excellence." —*Customer comment*

Characteristics

Test section dimensions	11 ft high by 11 ft wide by 22 ft long
Area	121 ft^2
Speed	Mach 0.20 to 1.45
Reynolds number	0.30 to 9.6×10^6 per ft
Temperature	110 ± 20 °F
Pressure	3.0 to 32 psia
Test gas	Air

Data Acquisition and Processing

Steady-State Data		
System	Channels	Sample frequency
Analog input	48	1000 Hz
Digital input	16	Test dependent
Force balances	32	1000 Hz
Pressure	2048	20 Hz
Temperature	60	10 Hz
Time Variant Data, High Speed		
System	Channels	Sample frequency
Analog	160	20-KHz bandwidth
Force balance	160	80-KHz bandwidth

Classified capability available.

Instrumentation

Strain gauge balances	Six component (full span) Five component (semi span)
Angle-of-attack (AOA) accelerometers	±15° with offsets to +45°

Contact Information

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